

# PATENT SPECIFICATION

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## (54) AN IMPROVED METHOD FOR CLEANING ARTICLES

(71) I. JAMES EPHRAIM LOVELOCK, a British citizen of Bowerchalke, Near Salisbury, Wiltshire, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates to a process for the cleansing of metal and other surfaces, the process taking place in the gas phase.

According to the present invention a process for the cleansing of metal and other surfaces comprises placing an article to be cleaned in a vessel the walls of which do not react with a fluorinating cleansing agent, introducing the fluorinating gaseous cleansing agent into the vessel, the amount of cleansing agent introduced being in excess of that required to react with contaminants on the article, and passing effluent emerging from the vessel through a trap containing a material capable of absorbing fluorine and other active products.

Preferably the cleansing agents are gaseous fluorine or chlorine trifluoride. Before their introduction to the vessel they will usually be diluted in an inert-gas such as argon or nitrogen or in some cases air. The containing vessel may be formed from metals which do not react with the cleansing agent. Examples of such metals are copper, steel and iron. Alternatively the vessel may be formed from polytetrafluoroethylene (P.T.F.E.) and transparent fluoride glasses.

The unused excess cleansing agent together with the reactive products of the cleansing operation are prevented from escaping into the atmosphere by being passed through the trap. The trap can comprise a tower containing activated carbon. The gases in the vessel are blown or swept into the tower by means of a second stream of nitrogen or other inert gas entering the reaction vessel on completion of the cleansing operation.

[Price 25p]

It will be appreciated that carbon is merely given as an example of one suitable material capable of absorbing fluorine and other active products.

Chlorine trifluoride can conveniently be stored in low pressure cylinders. Fluorine cylinders being more hazardous to handle it is convenient to generate this gas in or adjacent to the cleansing vessel by means of an electrolytic generator.

Where small or inaccessible surfaces require cleaning, for example, the commutator or slip rings of an electric motor or alternator, a stream of the cleansing gas in nitrogen or other inert gas can be projected at the part to be cleaned. The concentration of fluorinating agent is kept as low as possible to prevent excessive heating of the article by the fluorination reaction. In such a process the fluorine concentration can be controlled by a temperature sensor located at or adjacent the article.

Yet again in cases where articles of a constant shape and size require cleaning, fluorine generators can be formed to fit over the article. For example for the cleaning of wire, rod or other elongated metal pieces, the generator can comprise two concentric cylinders; the inner cylinder being a porous nickel or carbon anode, the outer cylinder a porous nickel cathode and the space between the cylinders containing a potassium hydrogen fluoride electrolyte. The wire or other elongated material is accommodated within the inner cylinder.

The above cleansing process effectively removes contaminants such as grease, animal and vegetable matter from surfaces.

As examples of surfaces other than metal which may be cleaned according to the invention there can be mentioned glass and semi-conductor materials.

In certain cases the reaction with the cleansing agent might be sufficiently vigorous to initiate spontaneous combustion when

air is used as the diluent. In such cases the cleansing agent will be carried by an inert gas.

WHAT I CLAIM IS:—

- 5 1. A process for the cleansing of metals and other surfaces which comprises placing an article to be cleaned in a vessel the walls of which do not react with a fluorinating gaseous cleansing agent, introducing the  
10 fluorinating gaseous cleansing agent into the vessel, the amount of cleansing agent introduced being in excess of that required to react with contaminants on the article, and passing effluent emerging from the  
15 vessel through a trap containing a material capable of absorbing fluorine and other active products.

2. A process as claimed in Claim 1 in

which the cleansing agent is gaseous fluorine or chlorine trifluoride.

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3. A process as claimed in Claim 1 or 2 in which the cleansing agent is introduced into the vessel by an inert carrier gas.

4. A process as claimed in Claim 3 in which the carrier gas comprises nitrogen  
25 or argon.

5. A process as claimed in any preceding Claim in which the trap comprises a column of activated carbon.

6. A process as claimed in Claim 1 for  
30 cleansing metals and other surfaces substantially as hereinbefore described.

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